

S
388.1
M41A;
1-VIII
v.1

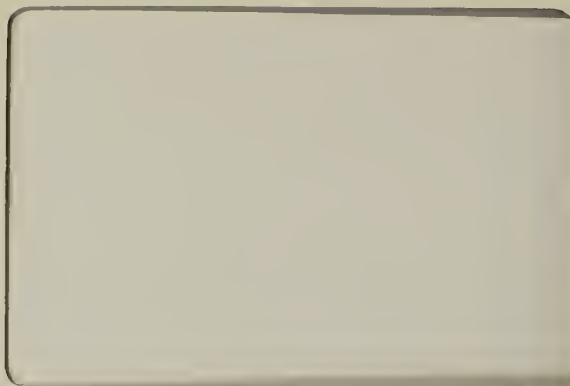
HIGHWAY INFORMATION SYSTEM
VOLUME 1: USER INFORMATION
CHAPTER 1-VIII
ACCIDENT ANALYSIS



Montana State Library



3 0864 1006 1822 5



AUG 15 1990

HIGHWAY INFORMATION SYSTEM
VOLUME 1: USER INFORMATION
CHAPTER 1-VIII
ACCIDENT ANALYSIS

MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

PLEASE RETURN

Prepared for

THE STATE OF MONTANA
DEPARTMENT OF INTERGOVERNMENTAL RELATIONS
HIGHWAY TRAFFIC SAFETY DIVISION

In cooperation with

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the Montana Highway Traffic Safety Division or the National Highway Traffic Safety Administration

Prepared by

Glen L. Martin, Michael J. Meldahl, Larry J. Coats, and
Leroy R. Zook

DEPARTMENT OF CIVIL ENGINEERING AND ENGINEERING MECHANICS
MONTANA STATE UNIVERSITY
Bozeman, Montana 59715

September, 1972

UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF THE SECRETARY

WASHINGTON, D. C.

PLEASE RETURN

TO THE OFFICE OF THE SECRETARY

OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

WASHINGTON, D. C.

2-10-1919

10-10-1919

FOREWORD

This chapter is the documentation of a portion of the highway information retrieval system research undertaken by the Department of Civil Engineering and Engineering Mechanics, Montana State University. This portion of the research was sponsored by the Highway Traffic Safety Division, Department of Intergovernmental Relations, State of Montana.

The first seven chapters, for which a Table of Contents is enclosed, serves as the basic documentation of the Highway Information System. That work, sponsored by the Planning and Research Bureau, Department of Highways, State of Montana, is reported in two volumes: Highway Information System Volume 1: User Information, and Highway Information System Volume 2: Programmer Information. Volume 1 deals with the use of the system, including information on data coding and on the execution of programs within the system. Volume 2 deals with the detailed operation of the system, providing information on the modification of programs existing within the system as well as on the addition of programs to the system. Each chapter of volume 1 is a prerequisite publication to the corresponding chapter of volume 2.

In addition to the tremendous amount of assistance furnished by personnel of the Highway Traffic Safety Division, the assistance of personnel of the Planning and Research Bureau and Traffic Design Unit of the Montana Department of Highways is also acknowledged.

Professor Alfred C. Scheer, Dr. Ralph W. Zimmer, Professor Robert C. Smith, and Mr. Philip A. House of Montana State University have collaborated with the authors to bring this portion of the research to a successful conclusion, and their efforts are gratefully acknowledged.

HIGHWAY INFORMATION SYSTEM

VOLUME 1: USER INFORMATION

TABLE OF CONTENTS

<u>Chapter</u>		<u>Page</u>
1-I	INTRODUCTION	1
	The Supervisor	3
	The Reference Post System	3
	The Roadlog Subsystem	4
	The Traffic and True Mileage Subsystem	6
	The Accident Subsystem	10
	The Sufficiency Subsystem	16
	Summary	16
1-II	ROADLOG USER INFORMATION	18
	Introduction	18
	Roadlog Mileage Record Coding	20
	Roadlog Descriptor Record Coding	20
	OS JCL Statements	36
	HIS Commands	36
	Continuation cards	36
	Comment cards	37
	Examples of valid HIS commands	37
	Examples of invalid HIS commands	37
	The DATA parameter	37
	Report and report summary commands	38
	LIST-&-SUM COMMAND	39
	SURF-TYPE COMMAND	40
	SUMMARY-BY-ROUTES COMMAND	41
	SUMMARY-BY-LOCATION COMMAND	41
	FORHWY-SUMMARY COMMAND	42
	SUM-LOOPS-&-SPURS COMMAND	42
	Formatting option parameters	43
	FORMAT PARAMETER	43
	PAGE-NUMBER PARAMETER	44
	TABLE-NUMBER PARAMETER	44
	TOP-MARGIN PARAMETER	45
	PAGE-EJECT PARAMETER	45
	Roadlog file maintenance	46
	DUMP COMMAND	46
	LIST COMMAND	47
	LIST-ILOOPS COMMAND	47
	UPDATE COMMANDS	48
	COPY COMMAND	49
	CREATE COMMAND	50
	Storage of the Roadlog data	51

Table of Contents (continued)

<u>Chapter</u>		<u>Page</u>
1-III	TRAFFIC AND TRUE MILEAGE USER INFORMATION	52
	The Traffic File	52
	Traffic Count Records	52
	Traffic Descriptor Records	56
	Coding Traffic Sections	56
	Defining traffic sections	56
	Rural and out-of-state sections	59
	Municipal sections	60
	Non-existent sections	60
	The True Mileage File	61
	OS JCL Statements	61
	HIS Commands	61
	Examples of valid HIS commands	61
	Report and report summary commands	63
	CREATE-TRAFSUB COMMAND	63
	LIST-TRAFSUB COMMAND	64
	TRAFFIC-BY-SECTIONS COMMAND	64
	SUMMARY-BY-ROUTES COMMAND	65
	Formatting option parameters	65
	FORMAT=NOREDUCE PARAMETER	65
	PAGE-NUMBER PARAMETER	66
	Traffic file maintenance commands	66
	DUMP COMMAND	66
	LIST COMMAND	66
	UPDATE COMMAND	67
	COPY COMMAND	69
	CREATE COMMAND	69
	UPDATE-BY-YEAR COMMAND	70
	True Mileage file maintenance commands	70
	LIST COMMAND	70
	UPDATE COMMAND	71
	COPY COMMAND	72
	CREATE COMMAND	73
	Storage of the Traffic and True Mileage data	73
1-IV	ACCIDENT USER INFORMATION	74
	The Accident Files	74
	Accident Detail Record Coding	74
	Accident Vehicle Record Coding	74
	OS JCL Statements	99
	HIS Commands	99
	Accident file maintenance procedures	99
	EDIT-DATA-CARDS COMMAND	99
	UPDATE-ERRORS COMMAND	104
	STORE-DATA-CARDS COMMAND	106
	LOAD-ACCIDENT-DATA COMMAND	107
	MERGE-ACCIDENT-FILES COMMAND	107

Table of Contents (continued)

<u>Chapter</u>		<u>Page</u>
1-IV (Cont'd)	Summary commands	108
	PRINT-MEMOS COMMAND	108
	NATIONAL SAFETY COUNCIL FORM 16 COMMAND	109
	Report commands	109
	CREATE-DIRECTORY and LOAD-ACC-DIRECTORY COMMANDS	110
	CREATE-ACCSUB COMMAND	111
	CREATE-ACC-LIMITS COMMAND	112
	ACCIDENT-BY-SECTIONS and MULTIPLE-ACC-LOCNS COMMANDS	112
	Storage of the Accident Data	113
1-V	SUFFICIENCY USER INFORMATION	114
	Introduction	114
	Sufficiency Rating Record Coding	114
	Sufficiency Descriptor Record Coding	114
	OS JCL Statements	118
	HIS Commands	119
	Report and summary commands	119
	CREATE-SUFFSUB,PHASE=SUFFICIENCY COMMAND	119
	CREATE-SUFFSUB,PHASE=ROADLOG COMMAND	120
	CREATE-SUFFSUB,PHASE=TRAFFIC COMMAND	121
	CREATE-SUFFSUB,PHASE=ACCIDENT COMMAND	123
	CREATE-SUFFSUB,PHASE=CALCULATION COMMAND	124
	LIST-BY-SECTION COMMAND	126
	LIST-BY-DISTRICT COMMAND	126
	LIST-BY-RATING COMMAND	127
	MAP-TABLES COMMAND	128
	RATING-BY-DISTRICT COMMAND	128
	DEF-MILES-BY-COUNTY COMMAND	129
	Sufficiency file maintenance commands	129
	UPDATE COMMAND	129
	COPY COMMAND	131
	CREATE COMMAND	132
1-VI	PRELIMINARY STUDY OF RETRIEVAL OF ROADWAY GEOMETRIC INFORMATION	133
	Introduction	133
	Roadway Locations	133
	The reference post system	133
	The stationing system	134
	Relationship between the reference post and stationing systems	135
	Geometrics Files	135
	The horizontal file	135
	The vertical file	137

Table of Contents (continued)

<u>Chapter</u>		<u>Page</u>
1-VI (Cont'd)	Geometrics Programs	139
	Vertical program	139
	Horizontal program	140
	Special conditions for the programs	140
	Geometrics Test Section	140
	Problems encountered	142
	Recommendations Concerning Geometrics File	143
1-VII	STORAGE AND RETRIEVAL OF VISUAL INFORMATION	145
	Introduction	145
	Microfilm Methods	146
	Roll/sheet/aperture card microfilm	147
	"Keyed microfilm"	148
	Central microfilm with remote access	148
	Computer Graphics Methods	149
	Summary	150
1-VIII	ACCIDENT ANALYSIS	151
	Introduction	151
	Municipal Accident Analysis	151
	HIGH-ACC-INTERSECTNS Program	151
	HIGH-ACC-INTERSECTNS COMMAND	156
	Rural Accident Analysis	159
	RURAL-ACC-CLUSTERS Program	159
	RURAL-ACC-CLUSTERS COMMAND	163
	RURAL-ACC-ANALYSIS Program	165
	RURAL-ACC-ANALYSIS COMMAND	167

LIST OF FIGURES

<u>Figure No.</u>		<u>Page</u>
1-I-1	HIS organization	2
1-II-1	Hypothetical stretch of highway	19
1-V-1	Traffic counts within a sufficiency section	122
1-VI-1	Sketch of test section	141

LIST OF TABLES

<u>Table No.</u>		<u>Page</u>
1-I-I	DATA ELEMENTS OF ROADLOG FILE RECORDS	5
1-I-II	DATA ELEMENTS OF TRAFFIC FILE RECORDS	7
1-I-III	DATA ELEMENTS OF TRUE MILEAGE FILE RECORDS	8
1-I-IV	DATA ELEMENTS OF TRAFFIC SUMMARY FILE RECORDS	9
1-I-V	DATA ELEMENTS OF ACCIDENT DETAIL FILE RECORDS	11
1-I-VI	DATA ELEMENTS OF ACCIDENT VEHICLE FILE RECORDS	12
1-I-VII	DATA ELEMENTS OF ACCIDENT DIRECTORY FILE RECORDS	13
1-I-VIII	DATA ELEMENTS OF ACCIDENT REPORT FILE RECORDS	14
1-I-IX	DATA ELEMENTS OF ACCIDENT LIMITS FILE RECORDS	15
1-I-X	DATA ELEMENTS OF SUFFICIENCY FILE RECORDS	17
1-II-I	DATA ELEMENTS AND CODING INFORMATION FOR ROADLOG MILEAGE RECORDS	21
1-II-II	ROUTE SYSTEM CODES	23
1-II-III	PROJECT NUMBER CODES	24
1-II-IV	REMARK CODES	25
1-II-V	COUNTY NAME CODES	26
1-II-VI	MILEAGE LOCATION CODES	27
1-II-VII	POPULATION CODES	28
1-II-VIII	CITY NAME CODES	29
1-II-IX	SURFACE TYPE CODES	30
1-II-X	DATA ELEMENTS AND CODING INFORMATION FOR ROADLOG DESCRIPTOR RECORDS	31
1-II-XI	EXPLANATION OF DESCRIPTION FIELD OF ROADLOG DESCRIPTOR CARDS	32
1-II-XII	FORMAT OF DESCRIPTION FIELD FOR "CO" DESCRIPTOR RECORDS	33
1-II-XIII	FORMAT OF DESCRIPTION FIELD FOR "IL" DESCRIPTOR RECORDS	35
1-III-I	DATA ELEMENTS AND CODING INFORMATION FOR TRAFFIC COUNT RECORDS	53
1-III-II	REMARK CODES	55
1-III-III	DATA ELEMENTS AND CODING INFORMATION FOR TRAFFIC DESCRIPTOR RECORDS	57
1-III-IV	DATA ELEMENTS AND CODING INFORMATION FOR TRUE MILEAGE RECORDS	62

List of Tables (continued)

<u>Table No.</u>		<u>Page</u>
1-IV-I	DATA ELEMENTS AND CODING INFORMATION FOR ACCIDENT DETAIL RECORDS	75
1-IV-II	COUNTY NAMES AND NUMBERS FOR ACCIDENT DETAIL FILE . .	77
1-IV-III	ACCIDENT LOCATION FIELD	78
1-IV-IV	FIRST HARMFUL EVENT CODES	79
1-IV-V	FIRST OBJECT HIT OFF ROADWAY CODES	80
1-IV-VI	INJURY SEVERITY CODES	81
1-IV-VII	DAMAGE SEVERITY CODES	82
1-IV-VIII	CLASS OF TRAFFICWAY CODES	83
1-IV-IX	JUNCTION-RELATED LOCATION CODES	84
1-IV-X	WEATHER CONDITION CODES	85
1-IV-XI	ROAD CONDITION CODES	86
1-IV-XII	LIGHT CONDITION CODES	87
1-IV-XIII	TRAFFIC CONTROL CODES	88
1-IV-XIV	OTHER DAMAGE TYPE CODES	89
1-IV-XV	ANALYSIS CODES	90
1-IV-XVI	COLLISION TYPE CODES	91
1-IV-XVII	DATA ELEMENTS AND CODING INFORMATION FOR ACCIDENT VEHICLE RECORDS	92
1-IV-XVIII	STATE CODES	94
1-IV-XIX	CONTRIBUTING CIRCUMSTANCES	95
1-IV-XX	INTENT	96
1-IV-XXI	BODY STYLE	97
1-IV-XXII	TRAILER STYLE	98
1-IV-XXIII	SEVERE ERROR MESSAGES AND USER RESPONSES	101
1-IV-XXIV	WARNING MESSAGES	102
1-V-I	DATA ELEMENTS AND CODING INFORMATION FOR SUFFICIENCY MILEAGE RECORDS	115
1-VIII-I	DATA ELEMENTS LISTED BY HIGH-ACC-INTERSECTNS	153
1-VIII-II	FORMAT OF GRID FILE DATA CARDS	154
1-VIII-III	CITY NAMES FOR THE LOCATION PARAMETER	155
1-VIII-IV	HIGH-ACC-INTERSECTNS ERROR CONDITIONS	160

List of Tables (continued)

<u>Table No.</u>		<u>Page</u>
1-VIII-V	DATA ELEMENTS LISTED BY RURAL-ACC-CLUSTERS	162
1-VIII-VI	RURAL-ACC-CLUSTERS ERROR CONDITIONS	166
1-VIII-VII	ACCIDENT AND VEHICLE DETAILS SUMMARIZED BY	

CHAPTER 1-VIII

ACCIDENT ANALYSIS

Introduction

The accident analysis software described herein is designed to run in conjunction with the Highway Information System (HIS) supervisor routine, and utilizes a number of the HIS data files.

The accident analysis software consists of two packages: 1) a municipal package and 2) a rural package. The municipal package consists of a single HIS command, and provides an analysis of intersections within cities. The rural package consists of two HIS commands, and provides capabilities for locating and "analyzing" accident "clusters" on rural roadways.

Municipal Accident Analysis

The municipal accident analysis package is designed to aid in locating intersections having higher numbers of accidents. The package consists of a single HIS command, which causes an interrogation of the accident file for accidents occurring at intersections within a specified city. Any of the 126 incorporated cities of Montana may be specified.

Accident locations within a city are specified by means of a two-dimensional coordinate system, or "grid." The grid consists of an x-coordinate ranging from 0000 to 2000 and a y-coordinate ranging from 0000 to 1000, overlaid onto a city map. The location of each accident occurring within the city is coded and stored in the HIS accident detail file.

The locations of intersections within a city are entered into the analysis program by means of a "grid file" prepared by the user. The name and the coordinates of each intersection for that city are included in the table.

HIGH-ACC-INTERSECTNS Program -- HIGH-ACC-INTERSECTNS is the program that assigns accidents within the city to the appropriate intersection. The user may select any of three methods of "analysis" for intersections with the specified city: 1) output a summary of accident information for each inter-

section within the city having more accidents than a specified number during a specified time period (#-ACCIDENTS mode); 2) output a summary of accident information for the specified number of intersections in a city having the greatest number of accidents during a specified time period (#-INTERSECTIONS mode); and 3) output a summary of accidents at individual intersections specified by name during the specified time period (individual intersections mode).

In each summary two listings are generated: 1) a list containing information pertaining to details of each accident (event) at that intersection, and 2) a list containing information pertaining to the vehicles and/or pedestrians involved in each of the accidents at that intersection. The items of information in each of the two listings are shown in Table 1-VIII-I.

As mentioned above, the intersection locations within each city are defined through a grid file prepared by the user. Each record of the grid file contains (see Table 1-VIII-II): 1) the x- and y-coordinate of the center of an intersection within the city, and 2) the common name for that intersection (e.g., SIXTH AND ROBERTS). Every intersection in the city that is significant when considering accidents must appear in the grid file. Each entry is keypunched onto a standard 80-column card in the format shown in Table 1-VIII-II. The grid file for each city is loaded into a disk file for future use with the following OS control cards and HIS command:

```
// EXEC HISACMA
//SYSIN DD *
:BUILD-GRID-TABLE,CITY=cityname,DDNAME=name
/*
//name DD *
        grid file data cards for specified city
/*
```

The city name is chosen from the list in Table 1-VIII-III. The name coded in the DDNAME parameter must match the name coded on the following DD * statement.

A listing of the grid table may be obtained by using the following OS control cards and HIS command:

TABLE 1-VIII-I
DATA ELEMENTS LISTED BY HIGH-ACC-INTERSECTNS

Listing	Items in Listing
Information pertaining to details of each accident (event)	<p> Accident number x-coordinate y-coordinate Date of occurrence Time of occurrence Day of week of occurrence Number of injuries Number of fatalities Number of vehicles Number of pedestrians First harmful event Collision type Junction-related location Weather condition Road condition Light condition Traffic controls </p>
Information pertaining to vehicles/pedestrians involved in the accident	<p> Accident number Vehicle or pedestrian number Driver age Driver sex Driver arrest (yes/no) Contributing circumstance Vision Contributing circumstance Road Contributing circumstance Mechanical (yes/no) Contributing circumstance Possible violation Intent Body style Trailer style Vehicle year Vehicle damage </p>

TABLE 1-VIII-III
CITY NAMES FOR THE LOCATION PARAMETER

ALBERTON	FLAXVILLE	OPHEIM
ANACONDA	FORSYTH	OUTLOOK
BAINVILLE	FORT-BENTON	PHILIPSBURG
BAKER	FROID	PLAINS
BEARCREEK	FROMBERG	PLENTYWOOD
BELGRADE	GERALDINE	PLEVNA
BELT	GLASGOW	POLSON
BIG-SANDY	GLENDIVE	POPLAR
BIG-TIMBER	GRASSRANGE	RED-LODGE
BILLINGS	GREAT-FALLS	REXFORD
BOULDER	HAMILTON	RICHEY
BOZEMAN	HARDIN	RONAN
BRIDGER	HARLEM	ROUNDUP
BROADUS	HARLOWTON	RYEGATE
BROADVIEW	HAVRE	SACO
BROCKTON	HELENA	ST-IGNATIUS
BROWNING	HINGHAM	SCOBAY
BUTTE	HOBSON	SHELBY
CASCADE	HOT-SPRINGS	SHERIDAN
CHESTER	HYSHAM	SIDNEY
CHINOOK	ISMAY	STANFORD
CHOTEAU	JOLIET	STEVENSVILLE
CIRCLE	JORDAN	SUNBURST
CLYDE-PARK	JUDITH-GAP	SUPERIOR
COLUMBIA-FALLS	KALISPELL	TERRY
COLUMBUS	KEVIN	THOMPSON-FALLS
CONRAD	LAUREL	THREE-FORKS
CULBERTSON	LAVINA	TOWNSEND
CUT-BANK	LEWISTOWN	TROY
DARBY	LIBBY	TWIN-BRIDGES
DEER-LODGE	LIMA	VALIER
DENTON	LIVINGSTON	VIRGINIA-CITY
DILLON	LODGE-GRASS	WALKERVILLE
DODSON	MALTA	WESTBY
DRUMMOND	MANHATTAN	WEST-YELLOWSTONE
DUTTON	MEDICINE-LAKE	WHITEFISH
EAST-HELENA	MELSTONE	WHITEHALL
EKALAKA	MILES-CITY	WH-SULPHUR-SPRINGS
ENNIS	MISSOULA	WIBAUX
EUREKA	MOORE	WINIFRED
FAIRFIELD	NASHUA	WINNETT
FAIRVIEW	NEIHART	WOLF-POINT

TABLE 1-VIII-II
FORMAT OF GRID FILE DATA CARDS

<u>Columns</u>	<u>Item</u>	<u>Remarks</u>
1-4	x-coordinate	See note 1 below
5-8	y-coordinate	See note 1 below
9-48	Intersection name	See note 2 below
49-80	Unused columns	

- Notes: 1. Each coordinate is coded as a four-digit number with all leading zeroes present.
2. The intersection name is a left-justified, 40-character, verbal description of the intersection.


```
// EXEC HISACCMA
//SYSIN DD *
:LIST-GRID-TABLE
/*
```

HIGH-ACC-INTERSECTNS COMMAND:

```
:HIGH-ACC-INTERSECTNS,CITY=cityname,
: [START-DATE=mm/dd/yy,] [END-DATE=mm/dd/yy,]

: [ACCIDENTS= { INTERSECTION
                  ALL
                },][MAX-#-ENTRIES=eeee,]

: SQUARE-SIZE=sss, { #-ACCIDENTS=aaa
                     #-INTERSECTIONS=iii
                     blank with no preceding comma
                   }
```

The CITY parameter is used to enter the name of the city for which the analysis is being made. Any one of the 126 cities of Montana may be specified, provided that: 1) the accidents occurring within the city are being reported on the coordinate system, and 2) a grid file defining the intersection locations within that city has been prepared and stored as described above. Table 1-VIII-III shows the city names as they must be coded on the command.

The START-DATE and END-DATE parameters are optional and may be utilized to limit the accidents, by date, being considered. When a START-DATE parameter is present, only accidents occurring on or following the specified date are considered. When the END-DATE parameter is present, only accidents occurring on or before the specified date are included. When both START-DATE and END-DATE are present, only accidents occurring on or between the specified dates are considered. When both START-DATE and END-DATE parameters are omitted, all accidents in the file are considered. Each date is coded as a two-digit month, day, and year separated by slashes. For example, November 2, 1983, is coded as 11/02/83.

The ACCIDENTS parameter may be used to limit the analysis scope to intersection and intersection-related accidents (INTERSECTION) or to include all accidents occurring within the city (ALL) during the time period specified.

The MAX-#-ENTRIES parameter specifies the maximum number of entries that are included in the grid file for the specified city. If the grid file contains 500 or fewer entries, the parameter need not be present. If the grid file contains more than 500 entries, the parameter must be present and must indicate a value at least as large as the number of entries in the grid file for that city. If the grid file contains more than the specified MAX-#-ENTRIES (or more than 500 entries if the parameter is not present), the program will be aborted. In the event that this occurs, specify a larger value in the MAX-#-ENTRIES parameter and rerun.

The SQUARE-SIZE parameter defines the size of each square used in assigning the accidents to an intersection. The number specified is the length of an edge of a square in coordinate units. The center of the square is coincident with the coordinates of the intersection. The value coded must range from 1 to 999.

The #-ACCIDENTS parameter is used in #-ACCIDENTS mode to indicate the minimum number of accidents that must occur at an intersection for that intersection to qualify as a reportable intersection. If an intersection is assigned fewer accidents than specified by #-ACCIDENTS, that intersection does not appear in any summaries. If an intersection is assigned a number of accidents equal to or greater than specified by #-ACCIDENTS the accidents assigned to that intersection are summarized. The value coded for #-ACCIDENTS may range from 1 to 999.

The #-INTERSECTIONS parameter is used to specify the number of intersections for which accidents are to be summarized for a city. The intersections involved in the summary are those with the greatest number of accidents assigned to them. For example, if #-INTERSECTIONS is specified as 5, then the five intersections with the greatest number of accidents assigned to them will appear in the summary. The value coded for #-INTERSECTIONS may range from 1 to 999.

A minimum amount of IBM OS/360 Job Control Language (JCL) is required in order to execute HIGH-ACC-INTERSECTNS. Examples of commands and accompanying OS JCL statements follow:

An example of #-ACCIDENTS and accompanying OS JCL is:

```
// EXEC HISACCMA
//SYSIN DD *
:HIGH-ACC-INTERSECTNS,CITY=GREAT-FALLS,START-DATE=01/01/72,
:  END-DATE=06/30/72,ACCIDENTS=INTERSECTION,
:  SQUARE-SIZE=05,#-ACCIDENTS=15
/*
```

An example of #-INTERSECTIONS and accompanying OS JCL is:

```
// EXEC HISACCMA
//SYSIN DD *
:HIGH-ACC-INTERSECTNS,CITY=GREAT-FALLS,
:  ACCIDENTS=ALL,SQUARE-SIZE=05,#-INTERSECTIONS=10
```

An example of the "Individual Intersections" command and accompanying OS JCL is:

```
// EXEC HISACCMA
//INTSECTN DD *
TENTH-AVE-S-&-TWENTY-FIFTH-ST
SMELTER-AVE-&-FIFTEENTH-ST
/*
```

Individual intersection
names, left-justified
and as named in
GRID TABLE.


```
//SYSIN DD *  
:HIGH-ACC-INTERSECTNS,CITY=GREAT-FALLS,  
:  START-DATE=01/01/72,ACCIDENTS=INTERSECTION,  
:  SQUARE-SIZE=03  
/*
```

A number of error conditions may arise during execution of HIGH-ACC-INTERSECTNS. The error messages generated and their probable causes are shown in Table 1-VIII-IV.

Rural Accident Analysis

The rural accident "analysis" package is designed to aid in locating and analyzing "clusters" of accidents on rural sections of roadways. The package consists of two HIS commands: 1) to locate higher accident locations by scanning highways for accident clusters, and 2) "analyzing" clusters after they are located.

The route number and milepoint of each accident occurring on a rural roadway is stored in the HIS accident detail file. From this information, the software is able to determine the distance between each accident on a route.

RURAL-ACC-CLUSTERS Program -- RURAL-ACC-CLUSTERS "scans" rural highways searching for accident clusters. The user defines to the program what is meant by an accident cluster by specifying a roadway length and a number of accidents. The program scans the specified highway, searching for sections of the given length having at least the given number of accidents. Each time a cluster is found, all of the information in the HIS accident-by-sections directory file pertaining to the accidents in the cluster is printed. The items printed are shown in Table 1-VIII-V.

The program operates by reading the first accident occurring on the specified highway from the accident-by-sections directory file, and then continues reading accidents to a milepoint equal to the milepoint of the first accident plus the distance specified as LENGTH. A check is made to determine whether at least the specified number of accidents was read before reaching this last accident (which is not within the specified roadway length). If the

TABLE 1-VIII-IV
HIGH-ACC-INTERSECTIONS ERROR CONDITIONS

<u>Message</u>	<u>Cause</u>
***** ERROR IN PHASE phasename *****	This message is printed whenever an error occurs during execution as an aid to the programmer. The specific error is also printed.
***** INVALID OR MISSING CITY PARAMETER *****	The city name coded in the CITY parameter did not match any of the names in Table 1-VIII-III. The CITY parameter may have been omitted from the command.
***** ERROR IN CODING DATE *****	Either the starting date or the ending date was coded in a format other than mm/dd/yy.
***** ERROR IN #-ACCIDENTS OR #-INTERSECTIONS PARAMETER *****	Either the value coded in the #-ACCIDENTS or in the #-INTERSECTIONS parameter contained non-numeric characters.
***** SQUARE-SIZE HAS ZERO VALUE *****	The SQUARE-SIZE parameter was omitted, or it was specified as a value of either zero or larger than 999.
***** GRID TABLE STORAGE OVERFLOW *****	The grid file contained more records than were specified in the MAX-#-ENTRIES parameter (or more than 500 if the parameter was not coded). Increase the MAX-#-ENTRIES allocation and re-run.
***** INVALID COORDINATES ***** accident number	The x- or y-coordinate field of an accident detail record contained a non-numeric character. The accident in error was not processed.
***** GRID DIRECTORY CONTAINS NO RECORDS *****	No accidents in the HIS data files met the criterion for inclusion in the analysis summaries. Possible causes are 1) an end-date that precedes a start-date, 2) a date range for which no data exists in the files, or 3) a square-size value that is too small.

MessageCause

***** ACCIDENT accident number DID NOT OCCUR AT AN
INTERSECTION DEFINED IN THE GRID TABLE *****

An accident occurring within the specified city and meeting all of the selection criterion specified on the command did not occur within the squares of any of the intersections defined in the grid file. This message is generated only for intersection and intersection-related accidents, and only when processing in #-ACCIDENTS or #-INTERSECTIONS mode.

***** UNKNOWN INTERSECTION intersection name *****

When processing in individual intersection mode, a card was read containing a name not matching any intersection names in the grid file.

***** NO VALID INTERSECTIONS READ *****

When processing in individual intersection mode, no cards were read containing intersection names matching names in the grid file.

***** NO ACCIDENTS OCCURRED AT INTERSECTION
intersection name *****

When processing in individual intersection mode, a card was read containing the name of an intersection at which no accidents occurred.

***** NO INTERSECTIONS ASSIGNED SUFFICIENT
ACCIDENTS *****

When processing in #-ACCIDENTS mode, there were no intersections having at least the number of accidents specified.

***** GRID TABLE CONTAINS NO ENTRIES
FOR SPECIFIED CITY *****

An attempt was made to process a city for which no grid file had been stored on disk by BUILD-GRID-TABLE.

TABLE 1-VIII-V
DATA ELEMENTS LISTED BY RURAL-ACC-CLUSTERS

<u>Item</u>
Route system
Route number
Milepoint
Accident number
Number of fatalities
Number of injuries
Number of roadway lanes
Date of occurrence
Hour of day
First harmful event
Type of collision
Road surface condition

number of accidents occurring within the LENGTH specified is equal to or greater than #-ACCIDENTS, a listing is printed for that section of roadway. The program then moves to the second accident on the roadway, and repeats the "look-ahead" from that point. Each time a cluster is found, a listing is printed.

RURAL-ACC-CLUSTERS COMMAND:

```
:RURAL-ACC-CLUSTERS,LENGTH=nn.nn, #-ACCIDENTS=aaa,
:  [START-DATE=mm/dd/yy,] [END-DATE=mm/dd/yy,]
:  [MAX- #-ACCIDENTS=aaaaa,]
```

```

:      DATA= {
                ALL
                INT
                PRIM
                SEC
                INT=r
                PRIM=r
                SEC=r
                INT=r-r
                PRIM=r-r
                SEC=r-r
              }
STARTKEY=startkey,ENDKEY=endkey
```

The LENGTH parameter defines roadway length in which a cluster must occur. The length is specified in miles, and must contain leading zeroes and a decimal point to conform to the format nn.nn. For example, a length of one-half-mile is coded as 00.50.

The #-ACCIDENTS parameter defines the minimum number of accidents occurring within the specified roadway length that will qualify the accidents in that roadway length to be classified as a "cluster." The value of the number of accidents coded may range from 1 to 999 (leading zeroes are not required).

The START-DATE and END-DATE parameters are optional and may be used to limit the accidents, by date, being considered. When a START-DATE parameter is present, only accidents occurring on or following the specified date are considered. When the END-DATE parameter is present, only accidents occurring on or before that date are considered. When both START-DATE and END-DATE are present, only accidents occurring on or between the specified dates are considered. When both START-DATE and END-DATE parameters are omitted, all accidents in the file are considered. Each date is coded as a two-digit month, day, and year separated by slashes. For example, January 21, 1972, is coded as 01/21/72.

The MAX-#-ACCIDENTS parameter may be used to indicate the maximum number of accidents that will occur within any highway section of the length specified in the LENGTH parameter. If a section is encountered having more than this number of accidents, the program will be aborted. Should this occur, code a larger value in the MAX-#-ACCIDENTS parameter, and rerun. If the maximum number of accidents that will occur in any roadway section will be 30 or less, the MAX-#-ACCIDENTS parameter need not be present.

The DATA parameter is used to indicate the route or routes being scanned. If the system code is followed by a single route number, only that route is scanned. If the system code is followed by two route numbers separated by a hyphen, those routes and all routes between are scanned (the second route number must have a larger number than the first). Examples of valid DATA parameters are DATA=INT, DATA=PRIM=3-8, and DATA=SEC=209. The DATA parameter provides a simple method of specifying highways under consideration when one or more entire highways are being processed. However, when it is desired that only a portion of a route be processed, a finer specification procedure is required. The beginning and ending "key," each consisting of the route system, route number, and milepoint on a route, are specified as the STARTKEY and ENDKEY parameters.

A minimum amount of IBM OS/360 Job Control Language (JCL) is required in order to execute RURAL-ACC-CLUSTERS. Examples of commands and accompanying OS JCL statements follow:

```
// EXEC HISACCA
//SYSIN DD *
:RURAL-ACC-CLUSTERS,LENGTH=00.75,#-ACCIDENTS=5,
:  START-DATE=01/01/72,END-DATE=12/31/72,
:  DATA=PRIM=3-14
/*
```

```
// EXEC HISACCA
//SYSIN DD *
:RURAL-ACC-CLUSTERS,LENGTH=05.00,#-ACCIDENTS=10,
:  MAX-#-ACCIDENTS=50,DATA=PRIM
/*
```

```
// EXEC HISACCA
//SYSIN DD *
:RURAL-ACC-CLUSTERS,LENGTH=00.50,#-ACCIDENTS=3,
:  START-DATE=01/31/72,STARTKEY=P005042+0.000,
:  ENDKEY=P005059+0.000
/*
```

```
// EXEC HISACCA
//SYSIN DD *
:RURAL-ACC-CLUSTERS,LENGTH=00.50,#-ACCIDENTS=10,DATA=ALL
/*
```

A number of error conditions may arise during the execution of RURAL-ACC-CLUSTERS. The error messages generated and their probable causes are shown in Table 1-VIII-VI.

RURAL-ACC-ANALYSIS Program -- RURAL-ACC-ANALYSIS is designed to "analyze" accident clusters. The analysis consists of a summary of all accidents occurring between two specified milepoints on any roadway. The accident summary information is supplied in three parts: 1) a plot of the accidents and the physical descriptions between the two milepoints on the roadway (the user must realize that regardless of the distance between the specified milepoints, the plot will be scaled to fit on one page), 2) the average daily traffic and

TABLE 1-VIII-VI
RURAL-ACC-CLUSTERS ERROR CONDITIONS

***** KEY ERROR IN TRUMILE FILE. KEY=key *****	An accident in the file specified a route system or route number that does not exist.
***** END OF FILE ENCOUNTERED FOR ACCIDENT DIRECTORY *****	This message will always be printed after processing the last route for which there is data in the file.
***** STARTKEY IS GREATER THAN ENDKEY *****	The key coded in the STARTKEY parameter was greater than that specified in the ENDKEY parameter.
***** STARTKEY OR ENDKEY MISSING *****	Either the STARTKEY parameter or the ENDKEY parameter or both (or the DATA parameter) was missing.
***** INVALID START-DATE OR END-DATE *****	Either the START-DATE or the END-DATE parameter contained a date in a form other than mm/dd/yy.
***** MISSING #-ACCIDENTS OR LENGTH *****	Either the #-ACCIDENTS or the LENGTH parameter was omitted from the command.
***** STORAGE OVERFLOW *****	At least one of the roadway sections contained more than the number of accidents specified by MAX-#-ACCIDENTS (or more than 30 if the parameter was not coded). Increase the MAX-#-ACCIDENTS allocation and rerun.

accident rate between the two milepoints on the roadway, and 3) a summary describing the accident and vehicle details for each accident occurring on the specified section of roadway. Table 1-VIII-VII lists the accident and vehicle details that are summarized.

RURAL-ACC-ANALYSIS COMMAND:

```
:RURAL-ACC-ANALYSIS,STARTKEY=startkey,  
:  ENDKEY=endkey,[START-DATE=mm/dd/yy,]  
:  [END-DATE=mm/dd/yy]
```

The STARTKEY, ENDKEY, START-DATE, and END-DATE parameters are as defined under RURAL-ACC-CLUSTERS COMMAND above.

A minimum amount of IBM OS/360 Job Control Language (JCL) is required in order to execute RURAL-ACC-ANALYSIS. Examples of commands and accompanying OS JCL statements follow:

```
// EXEC HISACCA  
//SYSIN DD *  
:RURAL-ACC-ANALYSIS,STARTKEY=P001032+1.680,  
:  ENDKEY=P001033+0.900,START-DATE=01/01/72,  
:  END-DATE=08/01/72  
/*
```

```
// EXEC HISACCA  
//SYSIN DD *  
:RURAL-ACC-ANALYSIS,STARTKEY=P005042+0.000,  
:  ENDKEY=P005052+0.200  
/*
```

A number of error conditions may arise during the execution of RURAL-ACC-ANALYSIS. The error messages generated and their probable causes are shown in Table 1-VIII-VIII.

TABLE 1-VIII-VII

ACCIDENT AND VEHICLE DETAILS SUMMARIZED BY RURAL-ACC-ANALYSIS

----- Accident Details -----

Accident milepoint
Accident number
Time of occurrence
Date of occurrence
Day of week of occurrence
Class of trafficway
Junction-related location
Roadway-related location
Was an engineering study requested or not
First harmful event
First object hit
Weather condition
Road Condition
Light condition
Traffic controls
Collision type
Injury severity

----- Vehicle Details -----

Accident number
Vehicle or pedestrian number
Driver age
Driver sex
Driver arrest (yes/no)
Contributing circumstance Vision
Contributing circumstance Road
Contributing circumstance Mechanical (yes/no)
Contributing circumstance Possible violation
Intent
Body style
Trailer
Vehicle year
Vehicle damage

TABLE 1-VIII-VIII

RURAL-ACC-ANALYSIS ERROR CONDITIONS

<u>Message</u>	<u>Cause</u>
***** ERROR IN PHASE phasename *****	This message is printed whenever an error occurs during execution as an aid to the programmer. The specific error is also printed.
***** STARTKEY IS GREATER THAN ENDKEY *****	The key coded in the STARTKEY parameter was greater than that specified in the ENDKEY parameter.
***** STARTKEY OR ENDKEY MISSING *****	Either the STARTKEY parameter or the ENDKEY parameter or both were missing.
***** STARTKEY AND ENDKEY DO NOT OCCUR ON THE SAME ROUTE *****	The STARTKEY parameter and ENDKEY parameter must contain the <u>same</u> route number.
***** INVALID START-DATE OR END-DATE *****	Either the START-DATE or the END-DATE parameter contained a date in a form other than mm/dd/yy.
***** STORAGE OVERFLOW *****	More accidents have occurred on the section of highway being analyzed than can be stored within the program. The length of the highway section must be shortened to reduce the storage requirements.
***** STARTKEY OR ENDKEY FALL WITHIN A COINCIDENT OR PRESENT TRAVELED WAY (PTW) *****	The section of highway being analyzed is coincident with or on the present traveled way (PTW) of a higher priority route. The STARTKEY parameter and the ENDKEY parameter must be on the highest priority route.

